Constricting Esophageal Lesions

Colon Interposition for Replacement, Combined With Radiotherapy for Carcinoma

IVAN D. BARONOFSKY, *M.D., Ph.D.*, San Diego

• **The use of colon for esophageal replacement is a procedure that should be considered in the treatment of benign and malignant esophageal lesions. The five-year survival data following operations for carcinoma of the esophagus are not outstanding. The combination of colon transplantation and radiotherapy before and after operation is a procedure that should be utilized if an effort is to be made to increase the survival rate.**

AS THE ESOPHAGUS has no excess of tissue, operations for removal of lesions from it entail replacement of the removed portion with either another portion of the gastro-intestinal tract or a plastic tube.

Stomach[5] or tubes formed from stomach,[9] segments of jejunum,[14] skin tubes[4] and tubes of plastic and other inert materials[3,7] have all been used in an attempt to reconstruct the esophagus. Difficulty in mobilization,[14] inadequate blood supply,[14] peptic esophagitis[11] and the formation of strictures and fistulas[8] have been encountered.

We have had excellent results with the use of colon transplants in esophageal replacement.[2] In previous reports we and others have shown the value of the colon in this technique.[1,6,10] Colon is relatively resistant to gastric secretions.[12] It is nourished by a marginal artery, which in most instances runs uninterrupted along its entire length.[1]

Colon is especially useful in the surgical treatment of carcinoma of the esophagus, for in that condition extensive submucosal lymphatic involvement beyond the gross confines of the tumor is invariable.[13] Total thoracic esophagectomy is a very adequate treatment, and transplanted colon serves well for replacement. This technique, combined with a method of split radiotherapy, we believe may give patients the best opportunity of cure. We believe also that it is applicable especially to the very unfavorable carcinoma of the upper third and middle third of the esophagus.

Technique

The technique varies, depending upon whether the lesion is malignant or benign. For malignant lesions, cobalt therapy is added to the staged resection of the esophagus, the sequence being as follows:

1. Cobalt therapy—2500 rads to lesion.
2. Esophagocologastrostomy.
3. Upon discharge from hospital, repeat cobalt therapy of 2500-3000 rads.
4. Three weeks later, transthoracic esophagectomy (right chest).

The preoperative preparation of the patient is very important. Before operation, barium enema studies must be done to make sure there is no disease of the colon. Then neomycin and sulfathalidine and vitamins K and C are given to prepare the colon and promote healing of the transplant.

The patient is placed on the operating table in the supine position with the neck extended. The entire chest, abdomen and neck are draped. An upper midline incision adequately exposes the colon and the stomach. The omentum is separated at its colonic insertion and the entire left colon, splenic flexure and transverse colon are mobilized. The distance from midneck to midstomach is measured. About three to four inches are added and this is the length of colon to be utilized. The midcolic artery is then identified and preserved, while the colon to be used is severed from its mesentery as far down the descending colon as necessary for length (Figure 1). The marginal arteries are carefully preserved. The colon and the marginal arteries are then transected at the proper site. The mesentery of the colon is severed.

A second team, meanwhile, has been isolating the cervical esophagus through an incision anterior to the sternocleidomastoid muscle. It is then transected and the distal end is closed with a purse-string suture of heavy silk. The heavy silk will act as an excellent marker for the future esophageal resection if that is contemplated.

A retrosternal tunnel with an opening large enough to admit two or three fingers is then started

Submitted August 13, 1963.

Clinical Professor of Surgery, University of Southern California School of Medicine, Los Angeles.

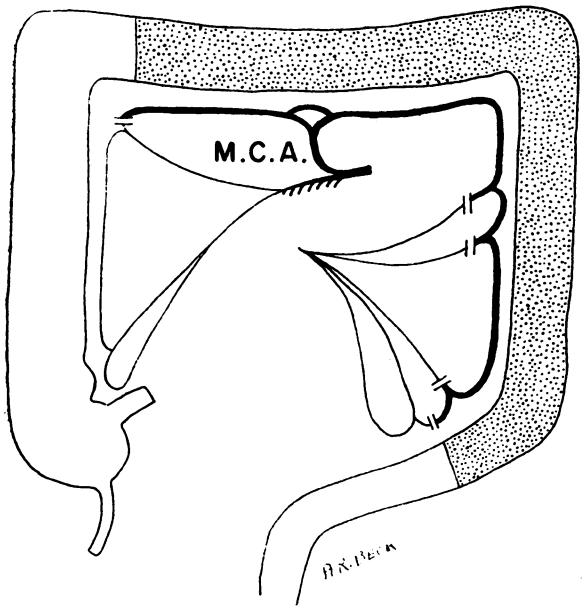

Figure 1.—Vascular pattern of the colon as encountered at operation. The shaded area represents the amount of colon available as a graft. In the pictures the right and left colic arteries and the first sigmoid artery have been divided. The viability of the transplanted colonic segment is entirely dependent on blood which it receives from the middle colic artery (M.C.A.).

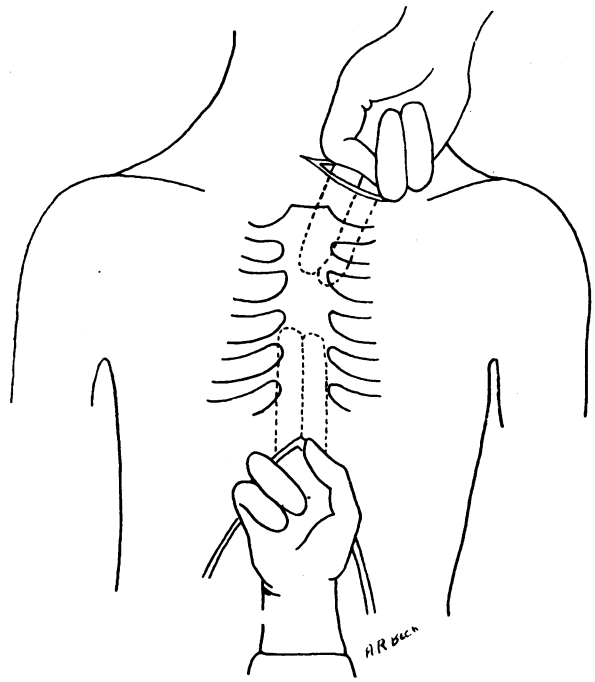

Figure 2.—The retrosternal tunnel is created by blunt dissection.

from below and above by blunt finger dissection (Figure 2). It can more safely be started from the abdominal side with a finger protecting the innominate vein during the upper dissection.

The next step is to bring the colon through an opening in the gastrohepatic ligament posterior to the stomach. It is then brought upward through the tunnel in an antiperistaltic position. Two-layer anastomosis is then carried out, first colon to esophagus and then colon to stomach (Figure 3). End to end anastomosis of the colon from which the graft was taken then is done. The upper portion of the stomach is used for the colon conduit. Gastrostomy may be added, but pyloroplasty should be done.

In the case of benign lesions, the operation ends with the foregoing procedure. In dealing with malignant lesions cobalt therapy is continued after operation, and three weeks after the last irradiation a repeat thoracotomy through the sixth interspace is used for the excision of the entire remaining esophagus. The stomach end is closed either with two layers of purse-string sutures or interrupted sutures.

REPORTS OF TWO CASES

CASE 1. A boy two and a half years old was admitted to Childrens Hospital on September 28. The diagnosis and history was conclusive for severe esophagitis and esophageal stricture, probably secondary to ingestion of lye or other caustic material. During the month of October, attempts were made to build the child up with intravenous feedings and other supportive measures. A course of steroid therapy was begun, and esophageal dilatations were attempted but proved to be too dangerous. In the last week of October, gastrostomy was done for feeding purposes.

After the operation the patient did only moderately well but on two occasions aspirated saliva. Transplant of a section of colon to the esophagus

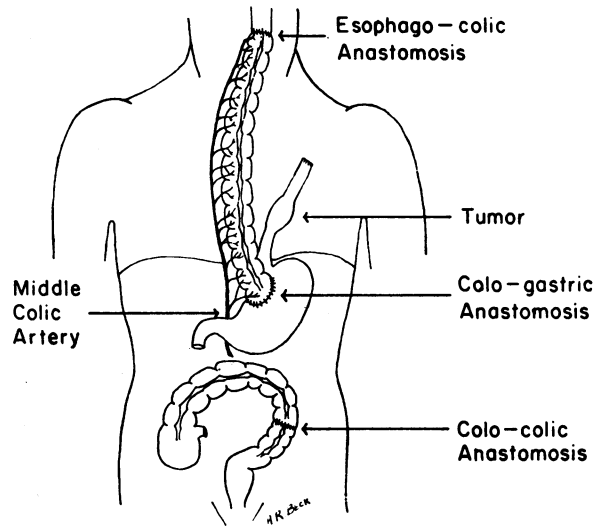

Figure 3.—Completed first stage.

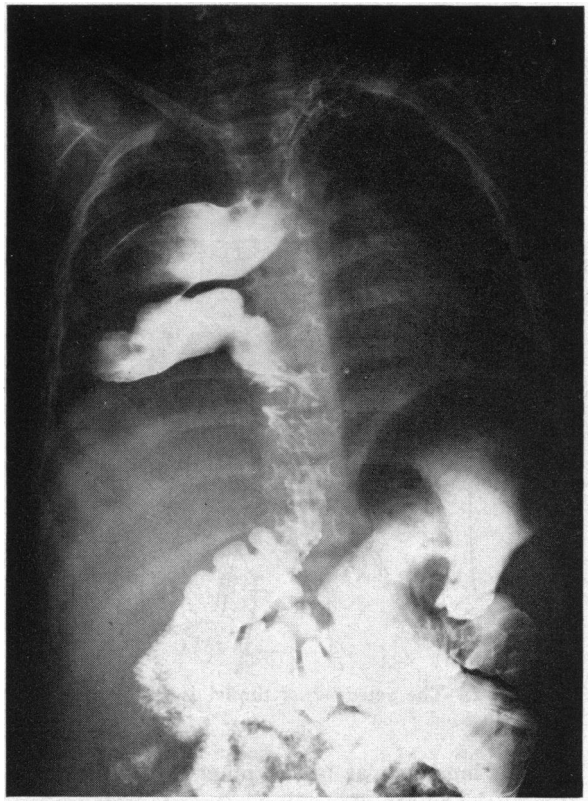

Figure 4.—(Case 1) Barium study showing left colon and redundancy of colon transplanted as substitute esophagus.

was carried out in the manner previously described. The length of colon used in the repair seemed redundant. Postoperatively a cervical fistula developed which healed after a period of time and the patient did exceptionally well thereafter. The opening in the stomach that had been made previously for feeding purposes was closed at a subsequent procedure.

There has been one complication which I believe is related to the excessive colon utilized. Symptoms that were related to this were related to the inability of food to empty quickly from the colonic segment. With conservative management this obstruction was completely relieved.

Comment: In this instance left colon placed in an antiperistaltic manner was utilized. The tremendous redundancy of the transverse colon and the presence of a pliable mesentery in young patients makes it an ideal esophageal substitute in infants and children. In this instance there was actually too much colon utilized, as may be seen in Figure 4. A more accurate measurement of length is in order. Whether isoperistaltic or antiperistaltic segments should be used is open to question. In a recent national meeting the suggestion that isoperistaltic segments would be better, brought forth a burst of comment suggesting that it made no difference. With regard to the blood supply, there is no question that viability will invariably be present.

CASE 2. The patient was a 51-year-old woman who began having difficulty in swallowing about a year before she was observed. She was able to swallow water, but salads and solid foods seemed to stick and this particular symptom had been getting worse progressively. Esophagoscopic examination was done and a lesion was seen in the upper third of the esophagus. Biopsy showed it to be squamous cell carcinoma. Cobalt therapy was begun and when the prescribed dose of irradiation had been given, transplantation of a segment of colon into the neck was accomplished. In this particular instance, the right colon was used because it was exceptionally long and the blood supply appeared adequate. Postoperative convalescence was excellent. As soon as the patient was discharged from the hospital, cobalt therapy was given again. Three weeks after completion of this treatment, total esophagectomy was accomplished through the right chest. There was no involvement of adjacent lymph nodes and the diagnosis of squamous cell carcinoma of the esophagus was reconfirmed. The patient did exceptionally well thereafter.

Comment: In this particular instance we were able to utilize the right colon. However, we prefer the left colon because of the greater margin of safety offered by its longer blood supply. The use of irradiation therapy before and after the transplant and the staged esophagectomy should be emphasized here. An obvious advantage of abdominal exploration is the ability to explore the abdomen for metastatic lesions. If any are present, the operation can be terminated at that point and further irradiation to the prescribed amount continued.

DISCUSSION

The use of the colon for cervical esophagogastric anastomosis has much merit and fistulas following it are rarely fatal. The mortality due to mediastinitis following a breakdown of extrathoracic anastomosis is extremely high.

Colon has distinct advantages over stomach, gastric tube and jejunum. We have shown these advantages as well as the advantages of the left colon over the right. The pattern of the marginal artery is constant on the left colon, whereas this is not so in the right colon. In our estimation, the preesophagectomy irradiation as we have used it in split doses has distinct advantages. The initial cobalt therapy will aid in sterilizing the lymphatic channels surrounding the tumor. Interposition of the colon at this point enables the patient to eat and gain

weight and strength. He can still eat during the irradiation that follows. Excision of the tumor and the esophagus three weeks after the final therapy can be done easily with little morbidity.

7910 First Street, San Diego, California 92123.

REFERENCES

1. Beck, A. R., and Baronofsky, I. D.: A study of the left colon as a replacement for the resected esophagus, Surgery, 48:499-509, 1960.

2. Beck, A. R., Kreel, I., and Baronofsky, I. D.: Use of the left colon to replace the esophagus, American Journal of Surgery, Vol. 101, January 1961.

3. Berman, E. F.: A plastic prosthesis for resected esophagus, Arch. Surg., 65:916, 1952.

4. Bircher, E.: Ein Beitrag zur Plastischen Bildung eines Neuen Oesophagus, Zentralbl. Chir., 34:1479, 1907.

5. Garlock, J. H.: Resection of the thoracic esophagus for cancer located above the arch of the aorta: Cervical esophagogastrostomy, Surgery, 24:1, 1948.

6. Luna, R. and Ernst, W. R.: Colon interposition for treatment of benign and malignant constricting esophageal lesions, J.A.M.A., 84:114, 1963.

7. Mackler, S. A. and Mayer, R. M.: Palliation of esophageal obstruction due to carcinoma with a permanent intraluminal tube, J. Thoracic Surg., 28:431, 1954.

8. Mahoney, E. B. and Sherman, C. D., Jr.: Total esophagoplasty using intrathoracic right colon, Surgery, 35:937, 1954.

9. Mes, G. M.: New method of esophagoplasty, J. Internat. Coll. Surgeons, 11:270, 1948.

10. Neville, W. E. and Clowes, G. H. A.: Colon replacement of esophagus in children for congenital and acquired disease, J. Thoracic and Cardiovascular Surgery, 40:507, 1960.

11. Ripley, H. R., Olson, A. M. and Kirklin, J. W.: Esophagitis after esophagogastric anastomosis, Surgery, 22:1, 1952.

12. Sirak, H. D., Clatworthy, H. W., Jr., and Elliot, D. W.: An evaluation of jejunal and colonic transplants in experimental esophagitis, Surgery, 35:399, 1954.

13. Watson, W. L., Goodner, J. T., Miller, T. P. and pack, G. T.: Torek esophagectomy: The case against segmental resection for esophageal cancer, J. Thoracic Surgery 32:348, 1956.

14. Yudin, S. S.: The surgical construction of eighty cases of artificial esophagus, Surg. Gynec. & Obst. 78:516, 1944.